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CONTRACT R&D TECHNICALLY ADMINISTERED BY THE ENERGY RESEARCH LABORATORIES - FY 1985/86

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MICROMEDIA

CONTRACT R&D TECHNICALLY ADMINISTERED BY THE ENERGY RESEARCH LABORATORIES FOR FY 1985/86

by

M. Skubnik*

In 1985/86 the Energy Research Laboratories (ERL) developed and administered 161 contracts and 4 financial contributions towards R&D programs. The contract value including financial contributions was $19,030,600 at an average value of $115,300. Of the 1985/86 ERL contracts, 58 were initiated by ERL staff, 11 were awarded through unsolicited proposals received from Supply and Services Canada (SSC), and 12 were awarded under the CANMET 50/50 Energy Conversion Program. The other 80 contracts were continued from 1984/85. A large percentage, about 44%, were or will be awarded to private companies, 28% to para-public organizations and 28% to Canadian universities.

In 1985/86 ERL technically administered $6,536,500 of the contract funds allotted to the Research Program Office (RPO). It is estimated that $8,698,300 will be carried over to 1986/87.

Sixty-six final reports, 34 journal publications, 30 conference presentations, 1 CANMET report and 8 patent applications were generated from these contract investigations.

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INTRODUCTION

In 1985/86 the Energy Research Laboratories (ERL) continued in-house research on conversion and utilization of fossil fuels as well as upgrading of synthetic fuels. To a lesser extent ERL was also involved in energy conservation and utilization of biomass for heating. The scope of ERL's activities in R&D is defined by 16 sub-sub-activities listed in Table 1. A new energy systems sub-sub-activity was transferred from the Office of Energy Research and Development (OERD) with funds of $455,500.

Traditionally, R&D contracts have been an inseparable part of ERL research activities comprising about 50% of ERL's budget. The objective of the contract program developed and administered by ERL is twofold: to encourage private industry to take an active part in R&D to facilitate the transfer of technology to industrial participants; and to utilize the resources and expertise of interested organizations to complement in-house research.

There are two types of research contracts:

i) 100% government funded contracts to complement in-house research projects or to verify novel and innovative ideas - these contracts are based on solicited and unsolicited proposals:

ii) 50/50 cost-shared contracts - 50% of the project costs is contributed by the contractor: these contracts are based mostly on solicited proposals under the CANMET 50/50 Energy Conversion Program.

This report summarizes the 1985/86 contracts and also presents financial expenditures and benefits from them. This report provides a base case for planning future activities.

CONTRACT R&D ADMINISTERED BY ERL

CONTRACT CLASSIFICATION

ERL administered 161 contracts and 4 financial contributions to R&D totalling $19,030,600. Of these 80 were continued from 1984/85 and the other 81 were initiated in 1985/86.

Of the 81 contracts, 58 were solicited, 11 were awarded from unsolicited proposals (UP) received from Supply and Services Canada (SSC) and 12 were 50/50 shared-cost contracts. Table 1 shows contract distribution by16 sub-sub-activities administered by the Hydrocarbon Processing Research Laboratory (HPRL), Synthetic Fuels Research Laboratory (SFRL) and Combustion and Carbonization Research Laboratory (CCRL). Table 2 lists contract titles, scientific authorities, contractor, contract values, dates of completion and status or outputs. Table 3 gives the values of solicited contracts, UP, 50/50 contracts and average contract values per sub-sub-activity and laboratory. Further details on these contract categories are given below.

SOLICITED CONTRACTS

For many years private research laboratories, para-public organizations and universities have been invited to contribute to and participate in CANMET's research activities. Fifty-eight such contracts were awarded in 1985/86 to complement ERL's in-house research. Twenty-six were tendered via requests for proposals (RFP) through SSC and 26 were negotiated with sole-sourced contractors. As indicated in Table 3 the total contract value for 1985/86 was $5,830,800 at an average value of $100,500.

UNSOLICITED PROPOSALS

In 1985/86 ERL received 19 unsolicited proposals through SSC totalling $1,886,000. Thirteen were funded for a total of $1,399,400 at an average value of $107,650. Proposals were submitted by Canadian companies, para-public organizations and universities having unique expertise and R&D capabilities.

50/50 SHARED-COST CONTRACTS

In 1985/86 ERL staff initiated 12 new shared-cost contracts. All were selected from proposals received under the 1985-86 CANMET 50/50 Energy Conversion Program. Twelve contracts were continued from 1984/85 under the same program.

Total value of the 24 shared-cost contracts in 1985/86 was $2,203,600. Table 4 lists total contract values and 1985/86 expenditures by sub-sub-activity.

In 1985/86 ERL also evaluated 24 proposals for the 1986/87 shared-cost program totalling $5,730,000. Fourteen contract proposals valued at $3,460,100 were accepted.

CONTRACTING ORGANIZATIONS

Of the 1985/86 contracts approximately 40% was awarded to private companies; about 28% to para-public organizations -including 15 contracts originally awarded to Gulf Canada (now Petro-Canada Inc.); and 28% to Canadian universities. Four per cent of contracts is under negotiation and will be awarded to private companies in 1986/87. Table 5 shows the types of contracting organizations and pertinent sub-sub-activities and laboratories.

CONTRACT EXPENDITURES IN 1985/86

The ERL contract expenditures in fiscal year 1985/86 were $6,536,500 and carryover into 1986/87 is estimated at $8,698,300. Table 6 lists the distribution of funds, percentage of fund utilization and number of contracts under each sub-sub-activity/laboratory.

Comparing fiscal year 1982/83 to subsequent years, as shown below, the ERL contract expenditures have gradually increased. This indicates a growing interest of Canadian organizations in energy R&D. The growth in fiscal year 1985/86 relative to 1982/83 was 54%. Assuming that all carried over funds will be spent the growth in 1986/87 could even reach 204%.

Fiscal year	Expenditure ($'000)	Growth (%)
1982/83	4236.3	0
1983/84	5754.0	36
1984/85	5973.7	41
1985/86	6536.5	54
1986/87	8637.2	204

OUTPUTS

In 1985/86, 66 contracts were completed and 66 reports will be available for public distribution. In addition these contracts produced 34 journal publications and 1 CANMET report. Scientific authorities together with contractors prepared, or are in the process of preparing 30 conference presentations. Based on contract investigations 8 patent applications have been in preparation. Table 7 gives further details on contract outputs generated according to sub-sub-activities and laboratories.

ACKNOWLEDGEMENTS

The author is grateful to S. Gilmour for her assistance in the preparation of this report. The author also thanks the ERL scientific authorities for information on the progress of their contracts.

Table 1 - Distribution of contracts by laboratory and sub-sub-activity

Sub-sub-activity laboratory	No. of contracts carried over from 1984/85			No. of 1985/86 contracts			Total
	Solicited	UP	50/50	Solicited	UP	50/50	
Development of catalytic processes for hydrocarbon conversion	9	3	2	5	2	2	23
Characterization of liquid fuels & development of separation processes	7	2	2	8	1	3	23
Conversion of natural gas to liquid fuels	2	2	2	7	1	1	15
Gasification and pyrolysis	2	3	1	6	1	1	14
HPRL total	20	10	7	26	5	7	75
Recovery of bitumen/heavy oils (contracts)	3	-	2	3	1	2	11
Recovery of bitumen/heavy oils (EMR contributions)	-	-	-	-	-	-	4
Development of upgrading technologies for bitumen/heavy oil	4	-	-	5	1	-	10
Evaluation of liquefaction and pyrolysis processes for Canadian coals	2	-	2	3	-	1	8
Development of bitumen/heavy oil & coal coprocessing technology	3	-	-	3	-	-	6
SFRL total	12	-	4	14	2	3	39*
Carbonization	1	-	1	2	-	-	4
Conventional combustion	2	2	-	2	-	2	8
Fluidized bed combustion	1	2	-	2	1	-	6
Coal-liquid mixture fuels	4	1	-	3	-	-	8
Combustion technologies for pollution abatement	1	-	-	3	1	-	5
Conservation in residential, industrial & transportation systems	10	1	-	1	2	-	14
Energy systems	-	-	-	5	-	-	5
Biomass fuels for residential and industrial utilization	1	-	-	-	-	-	1
CCRL total	20	6	1	18	4	2	51
ERL total	52	16	12	58	11	12	165*

UP - unsolicited proposal, 50/50 - cost-shared contracts
* Including 4 financial contributions

Table 2 - List of 1985/86 contracts

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL					
5017 - DEVELOPMENT OF CATALYTIC PROCESSES FOR HYDROCARBON CONVERSION AND DISTILLATE UPGRADING					
Compositional analysis of hydrotreated middle distillates from synthetic crudes by mass spectrometry, 2-9182	M. Wilson	Petro-Canada Inc.	112.0	03/87	In progress
The impact of nitrogen compounds on the processing of synthetic gas oil, 4-9073 (50/50 cost-sharing)	J. Monnier	Petro-Canada Inc.	132.8	02/86	Final report, conference presentation & publication
Characterization of virgin and hydrogenated liquids from spouted bed pyrolysis of Canadian coals, 4-9074	M. Skubnik	University of British Columbia	213.6	05/86	In progress
Study of hydrodesulphurization reactions on thin film cobalt molybdenum catalyst surfaces, 4-9125	J. Brown	University of Western Ontario	49.9	03/86	Final report, 5 conference presentations, 3 publications 1 patent appl.
Development of a rapid GC/MS method using a Finnigan 3400 GC/MS instrument for type characterization of hydrocarbons, 4-9127	R. Lafleur	Zenon Environmental Inc.	118.6	05/86	In progress
Analyses of synthetic crude middle distillate fractions by C-13 NMR, 4-9143	M. Wilson	Carleton University	72.7	09/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5017 - DEVELOPMENT OF CATALYTIC PROCESSES FOR HYDROCARBON CONVERSION AND DISTILLATE UPGRADING (cont'd)					
Préparation de nouveaux catalyseurs à base de métaux supportés sur ZSM-5 pour la désoxygenation de composés organiques, 4-9144	J. Monnier	Université Laval	89.4	04/86	In progress
Hydrogenation and its effects on fluid catalytic cracking unit feedstocks, 4-9145 (50/50 cost-sharing)	S. Ng	Petro-Canada Inc.	68.4	08/85	Final report, conference presentation & publication
Treatment of pitch with methanol, 4-9188	D. Fung	Sandwell and Company Limited	93.5	01/86	Final report
Software development for automated R&D system in distillate upgrading, 4-9240	C. Fairbridge	Sharon Professional Services	104.6	03/86	Final report, conference presentation & publication
Role of catalyst in heteroatom removal during hydroprocessing of model compounds, 4-9161	C. Fairbridge	University of Alberta	59.6	12/85	Final report, conference presentation, CANMET report & 3 publications
Literature review on pitch utilization and technical proposal for catalytic pitch conversion system, 4-9302	S. Ng	Hatch Assoc. Ltd.	64.1	03/86	Final report, conference presentation & publication

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5017 - DEVELOPMENT OF CATALYTIC PROCESSES FOR HYDROCARBON CONVERSION AND DISTILLATE UPGRADING (cont'd)					
Valorisation des résidus d'huiles lourdes par pyrolyse sous vide, 4-9310	J. Monnier	Universite de Sherbrooke	69.1	01/86	Final report
Upgrading of synthetic crude distillates with commercial hydrotreating catalysts, 4-9318	M. Sekhar	Stearns Catalytic Ltd.	131.7	09/86	In progress
Primary thermal upgrading of residua to transportation fuels, 5-9034	D. Fung	Petro-Canada Inc.	69.9	09/86	In progress
Dearomatization of synthetic crude, 5-9051	J. Kriz	University of Ottawa	30.5	10/86	In progress
Development of metal cluster catalyst for conversion of middle distillate fractions of synthetic fuels, 5-9074	M. Wilson	University of Toronto	245.0	09/87	In progress
The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes, 5-9130 (50/50 cost-sharing)	S. Ng	Petro-Canada Inc.	117.7	09/86	In progress
Preparation and catalytic activity of supported group V B and VI B metal clusters, 5-9131	C. Fairbridge	University of Calgary	55.9	12/86	In progress
Experimental evaluation of catalyst deactivation caused by asphaltene adsorption, 5-9135	M. Sekhar	New Grade Energy Inc.	147.0	02/87	Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5017 - DEVELOPMENT OF CATALYTIC PROCESSES FOR HYDROCARBON CONVERSION AND DISTILLATE UPGRADING (cont'd)					
Characterization of tin catalysts by Mössbauer spectroscopy, 5-9137	J. Monnier	Concordia University	10.6	03/86	Final report and publication
Catalytic hydrocracking of heavy oils in a layered fixed bed, 5-9154	J. Kriz	New Grade Energy Inc.	231.0	03/87	Under negotiation
Development and evaluation of catalysts for hydrogenation of raw Cold Lake pitch, 5-9231	M. Ternan	Guelph Chemical Laboratories Ltd.	87.7	12/86	In progress
5023 - CHARACTERIZATION OF LIQUID FUELS & SEPARATION PROCESSES					
The separation of saturates and aromatics from syncrude middle distillate, 4-9110 (50/50 cost-sharing)	S. Coulombe	Petro-Canada Inc.	157.2	06/86	In progress
The compositional study of nitrogen and oxygen compounds in products of heavy oil primary and secondary upgrading processes, 4-9111 (50/50 cost-sharing)	S. Coulombe	Petro-Canada Inc.	106.1	01/86	Final report and publication
Reverse osmosis separation of model compounds in heptane and toluene solutions, 4-9132	B. Farnand	Zenon Environmental Inc.	67.5	04/86	In progress
Selective identification of olefins and paraffins in middle distillates of synthetic crude oils, 4-9133	S. Coulombe	Petro-Canada Inc.	72.0	04/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5023 - CHARACTERIZATION OF LIQUID FUELS & SEPARATION PROCESSES (cont'd)					
The investigation of the supercritical extraction of sulphurous and nitrogenous components from synthetic crudes, 4-9157	H. Sawatzky	Technitrol Canada Ltd.	69.3	01/86	Final report
Analytical methods development and characterization requirements for projects on resource characterization, 4-9158	R. Lafleur	Alberta Research Council	43.3	12/86	In progress
A study into the separation of nitrogenous materials from naphtha fractions, 4-9176	G. Jean	The Cambrian Engineering Group Ltd.	73.0	05/86	In progress
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 4-91911	H. Sawatzky	Petro-Canada Inc.	45.0	03/86	Final report
Segregation of problematic components in synthetic hydrocarbon fuel fractions using membrane separation technologies such as reverse osmosis, 4-91912	B. Farnand	Memtek Corporation	38.9	12/85	Stopped
Adsorption of nitrogen compounds, 4-9291	G. Jean	Université Laval	111.2	12/87	In progress
Exploratory investigation of low pressure rotating dynamic membrane process for treating bitumen/water/mineral emulsions, 4-9307	B. Farnand	SNC Inc.	70.4	01/86	Final report

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5023 - CHARACTERIZATION OF LIQUID FUELS & SEPARATION PROCESSES (cont'd)					
Quality and application of asphalt derived from upgraded heavy crude, 5-9075 (50/50 cost-sharing)	H. Sawatzky	Esso Petroleum Canada	20.5	04/86	In progress
Selective extraction of nitrogen constituents from fluid catalytic cracking feedstocks, 5-9085 (50/50 cost-sharing)	H. Sawatzky	Petro-Canada Inc.	51.6	07/86	In progress
Processability and reactivity of heavy ends, 5-9090 (50/50 cost-sharing)		Petro-Canada Inc.	47.7	07/86	In progress
Membrane processing of oil field produced water for enhanced oil recovery (EOR) steam generation, 5-9111	B. Farnand	Zenon Environmental Inc.	189.4	06/86	In progress
The effect of nitrogenous concentrates from synthetic crude on asphalt blends, 5-9132	H. Sawatzky	Petro-Canada Inc.	49.8	03/86	Final report
Detailed study of the influence of experimental conditions on retention time in size exclusion chromatography of bitumens/heavy oils/asphaltenes 5-9134	S. Coulombe	RFP	77.0	10/86	Under negotiation
Separation of sulphurous components in synthetic crude fraction, 5-9136	P. Chantal	Geotechnical Resources Ltd.	77.1	03/87	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5023 - CHARACTERIZATION OF LIQUID FUELS & SEPARATION PROCESSES (cont'd)					
Separation and characterization of surfactants present in emulsions in enhanced recovery process 5-9147	H. Sawatzky/ S. Coulombe	C.A. Shook Consulting Ltd.	90.0		Under negotiation
Reverse osmosis separation of methanol from ethers and unreacted olefins, 5-9150	B. Farnand	Zenon Environmental Inc.	165.0		Under negotiation
A techno-economic evaluation of conventional, synthetic and oxygenated gasoline blending components, 5-9175	H. Sawatzky	Petro-Canada Inc.	125.4	06/86	In progress
Development of a process for treating oil-water-mineral emulsions from in-situ recovery operations, 5-9176	H. Sawatzky	Zenon Environmental Inc.	97.8	08/86	In progress
Processing studies of bitumens/heavy oils produced by recovery methods of diverse nature, 5-9222	H. Sawatzky	Saskatchewan Research Council	63.5		In progress
5031 - CONVERSION OF NATURAL GAS TO LIQUID FUELS					
Gaz de synthèse/essence synthétique, 4-9082	G. Jean	Centre de Recherche Industrielle du Québec	148.4	03/86	Final report, conference presentation, 2 publications & 2 patent applications

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5031 - CONVERSION OF NATURAL GAS TO LIQUID FUELS (cont'd)					
Conversion du methane en essence automobile par réaction d'une cathode creuse, 4-9117	V. Allenger	Université du Québec à Chicoutimi	44.3	02/86	Final report, conference presentation, and publication
Technical and economic assessment of producing distillate fuels via an electricity based acetylene process - Phase II, 4-9146	D. Fung	SNC Inc.	125.3	03/86	Final report
Direct production of gasoline range hydrocarbons from syngas in a dual bed reactor system, 4-9247	S. Ng	University of Saskatchewan	77.8	01/86	Final report, conference presentation and publication
Direct partial oxidation of methane to methanol over designed heteropoly catalysts, 4-9271	J. Brown	University of Waterloo	152.0	03/87	In progress
Conversion of methane over selected solid catalysts, 4-9281	V. Allenger	Petro-Canada Inc.	45.0	06/86	In progress
Product optimization of the direct conversion process of natural gas to methanol by controlled oxidation, 5-9033	D. Fung	University of Manitoba	90.0	04/86	In progress
Development and characterization of selected synthesis catalysts, 5-9088	J. Galuszka	University of Saskatchewan	39.6	05/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5031 - CONVERSION OF NATURAL GAS TO LIQUID FUELS (cont'd)					
Direct catalytic conversion of natural gas to higher hydrocarbons, 5-9089	J. Galuszka	British Columbia Research Council	36.3	01/86	Completed with reduced tasks
Project Gasolsyn, 5-9095	G. Jean	Concordia University	110.0	08/86	In progress
Investigation of process conditions for the synthesis of liquid distillates from light olefins and methanol, 5-9113	B. Farnand	Petro-Canada Inc.	106.5	07/86	In progress
Thermally coupled pressure swing adsorption for natural gas conversion to liquid fuels, 5-9144	D. Liu	Highquest Engineering Inc.	45.0	04/86	In progress
Conversion of methane into methanol using methanotrophs, 5-9145	D. Fung	Gemini Biochemical Research Ltd.	44.0	08/86	In progress
Catalytic conversion of natural gas to hydrocarbons, 5-9178 (FE)		NRC	30.0	03/86	Completed
Methane conversion using a hollow cathode, 5-9233	G. Jean	Université du Québec	86.4		Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5046 - GASIFICATION AND PYROLYSIS					
Rapid pyrolysis of New Brunswick oil shales, 4-9000	E. Furimsky	University of British Columbia	33.0	04/85	Final report
Gasification of oil sands coke, 4-9018	D. Fung	University of British Columbia	141.5	12/85	Final report
Conversion of coal rejects to liquid fuel via indirect liquefaction, 4-9061 (50/50 cost-sharing)	E. Furimsky	Westar Mining Ltd.	46.3	06/85	Final report
Gasification reactivities of ultrasonically treated coal rejects, 4-9211	B. Nandi	Carleton University	21.4	05/85	Final report
Upgrading of Nova Scotia oil shales for potential uses, 4-9267	L. Janke	Technical University of Nova Scotia	62.8	01/86	Final report, conference presentation and publication
Evaluation of processing options for the oil shales of Ontario, 4-9311	M. Skubnik	Watts, Griffis & McOuat Ltd.	45.3	07/85	Final report, conference presentation and publication
Modification of integrated oil shale retort system, 5-9028 (50/50 cost-sharing)	E. Furimsky	Research and Productivity Council	40.0	03/86	Final report
Hot gas clean up of gasification products, 5-9048	A. Palmer	University of British Columbia	150.9	07/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by HPRL (cont'd)					
5046 - GASIFICATION AND PYROLYSIS (cont'd)					
Entrained gasification of Syncrude coke, 5-9127	E. Furimsky	Texaco Inc.	24.9	03/86	Final report
Gasification of Canadian anthracite coal in fluidized bed reactor, 5-9139	D. Fung	University of British Columbia	27.1	09/86	In progress
Preparation of oil sand coke-water slurry for entrained bed gasifier, 5-9140	A. Palmer	Carleton University	47.8	09/86	In progress
Process evaluation of an integrated retorting co-combustion system, 5-9146	E. Furimsky	Monenco Consultants Ltd.	120.0		In progress
Pyrolysis of New Brunswick oil shale and coal in fluidized bed reactor, 5-9195	A. Palmer	Research and Productivity Council	57.0		Under negotiation
Hydrotreating of liquids derived from New Brunswick oil shale deposits, 5-9199	M. Sekhar	RFP	150.0		Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL					
5006 - RECOVERY OF BITUMEN/HEAVY OILS					
Wet oxidation from in situ oil recovery - Phase I 3-9166	D. Faurschou	Ontario Research Foundation	197.1	10/85	Final report
Steam injection experiments in a scaled physical model, 3-9167	D. Faurschou	University of Alberta	300.0	06/85	Final report, 4 conference presentations & 4 publications
Numerical simulation of steam injection in bitumen and heavy oil reservoirs: Phase I, development of methodology for a 2-dimension dynamic grid simulator, 3-9168	D. Faurschou	University of Toronto	110.0	10/85	Final report, conference presentation & publication
Influence of the reservoir matrix on the mechanism and kinetics of the in-situ combustion process for heavy oil recovery, 4-9058 (50/50 cost-sharing)	D. Faurschou	Gulf Canada Ltd.	75.0	11/85	Final report
The use of surfactant waterflooding as an enhanced recovery process for heavy oils, 4-9059 (50/50 cost-sharing)	D. Faurschou	Gulf Canada Ltd.	71.0	07/85	Final report, conference presentation & publication
Evaluation of steam additives and clay stabilizers for enhanced heavy oil recovery process, 5-9066	A. George	Gulf Canada Ltd.	112.7	06/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL (cont'd)					
5006 - RECOVERY OF BITUMEN/HEAVY OILS (cont'd)					
Impact of drilling and completion fluids on the productivity of heavy oil recovery processes, 5-9067	D. Faurschou	Gulf Canada Ltd.	81.6	06/86	In progress
Steam injection experiments in scaled physical models for simulating marginal reservoirs, 5-9112	A. George	University of Alberta	319.7	03/88	In progress
Remote monitoring of frontal movements, 5-9126 (EMR contribution)	D. Faurschou	AOSTRA	650.0		In progress
Fuel options for enhanced oil production, 5-9142	D. Faurschou	L.A. Smith & Assoc.	15.0	09/85	Final report
Numerical simulation of steam injection in bitumen and heavy oil reservoirs: Phase II Development of methodology for a 3-dimension dynamic grid simulator, 5-9235	D. Faurschou	University of Toronto	73.0		Under negotiation
Steam recovery processes with addition of non-condensible gases - A mechanism study, 5-9240	D. Faurschou	Geotechnical Resources Ltd.	330.0		Under negotiation
Bitumen recovery, 5-9262 (EMR contribution)	D. Faurschou	AOSTRA	9.1	04/86	In progress
OSBC, Phase III, 5-9263 (EMR contribution)	D. Faurschou	AOSTRA	5.5	03/86	Completed
UMATAC process demonstration (AOSTRA-industry demonstration), 6-9004 (EMR contribution)	D. Faurschou	AOSTRA	2,500.0		Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL (cont'd)					
5012 - DEVELOPMENT OF UPGRADING TECHNOLOGY					
Design, construction and technical development of gamma-ray densitometer for the Canada Centre for Mineral and Energy Technology hydrocracking and co-processing systems, 2-9129	D. Liu	Atomic Energy of Canada Ltd.	380.3	08/85	Final report
Residence time distribution studies for scale-up of the CANMET hydrocracking process - Phase II, 4-9017	I. de Bruijn	University of Waterloo	288.4	07/86	In progress
Continuation de l'étude sur la nature de coke provenant des charbons rang peu élévé et des huiles lourdes, 4-9049	J.A. MacPhee	Université de Sherbrooke	83.2	01/86	Final report
Kinetic studies of coke formation in hydrocarbon fractions of different bitumens under various conditions - Phase II, 4-9090	B. Nandi	University of Ottawa	138.5	10/85	Final report
High temperature EPR studies of the thermolysis of heavy oil and its components, 5-9151	F. Ng	University of Guelph	160.0		In progress
Biological methods of upgrading of bitumen, heavy oil and residue, 5-9184	F. Ng	University of Waterloo	78.0		In progress
Preliminary feasibility study of a rapid pyrolysis process (Ultrapyrolysis) to produce ethylene, valuable chemical intermediates or high quality gas from CANMET hydrocracker bottoms and typical CANMET hydrocracker feedstock	P. Sears	Ensyn Engineering Assoc. Inc.	65.9	11/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL (cont'd)					
5012 - DEVELOPMENT OF UPGRADING TECHNOLOGY (cont'd)					
Kinetic studies of coke formation in hydrocarbon fractions of different bitumens under various conditions, Phase III, 5-9189	B. Nandi	University of Ottawa	132.0	03/87	In progress
Dual energy gamma-ray densitometer, 5-9213	D. Liu	Atomic Energy of Canada Ltd.	36.5	08/86	Under negotiation
Hydrocracking of individual components isolated from heavy oil and residual fuels, 5-9215	W. Dawson	RFP	130.0		Under negotiation
5036 - EVALUATION OF LIQUEFACTION AND PYROLYSIS FOR CANADIAN COALS					
Investigation of the use of spherical agglomeration in the beneficiation of low rank Canadian coals as an integral part of a direct liquefaction process, 3-9111	R. Mikula	SNC Inc.	75.1	10/85	Final report, 2 patent applications
A study of the liquefaction of Nova Scotia coals, Phase VI, 4-9060 (50/50 cost-sharing)	D. Faurschou	N.S. Research Foundation Corp.	138.5	11/85	Final report, conference presentation & publication
Continuation of the evaluation of Hat Creek coal for coal liquefaction, 4-9081 (50/50 cost-sharing)	S. Fouda	B.C. Research Council	142.4	12/85	Final report

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL (cont'd)					
5036 - EVALUATION OF LIQUEFACTION AND PYROLYSIS FOR CANADIAN COALS (cont'd)					
Techno-economic comparison of the Sandwell Centrax solid-liquid separation process with the Kerr McGee critical solvent deashing process as part of an integrated two-stage liquefaction process, 4-9268	J. Kelly/ M. Ikura	The Mitre Corporation	77.0	06/86	In progress
Characterization of solid residue from coal liquefaction processes, 5-9104	W. Dawson	University of Regina	96.6	03/86	Final report, conference presentation
Liquefaction studies of Nova Scotia coals, 5-9152 (50/50 cost-sharing)	P. Rahimi	N.S. Research Foundation Corp.	124.7	07/86	In progress
Hydropyrolysis of Eastern Canadian coals, 5-9162	M. Ikura	Ontario Research Foundation	96.7	04/86	In progress
Critical evaluation of the hardware development for the Sandwell Centrax process, 5-9241	J. Kelly/ M. Ikura	Sandwell Beak Group Ltd.	8.3	03/86	Final report
5041 - DEVELOPMENT OF BITUMEN/HEAVY OIL COPROCESSING					
Evaluation of the Sandwell Centrax process for the separation of solids and recovery of liquid products from 10 different slurry samples, 4-9206	S. Fouda	Sandwell and Company Ltd.	41.3	08/85	Final report

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by SFRL (cont'd)					
5041 - DEVELOPMENT OF BITUMEN/HEAVY OIL COPROCESSING (cont'd)					
Investigation of the use of spherical oil agglomeration in the beneficiation of low rank Canadian coals as an integrated part of CANMET coprocessing process, 4-9238	M. Ikura	SNC Inc.	95.0	11/86	In progress
Techno-economic study of CANMET coprocessing technology -20,000 bbl/d syncrude from Cold Lake bitumen, 4-9306	M. Ikura/ J. Kelly/ R. Dunn	Partec Lavalin Inc.	114.5	02/86	Final report
Evaluation of atmospheric flash pyrolysis for coprocessing residue, 5-9168	S. Fouda	University of Waterloo	113.7	09/86	In progress
To develop, design, construct and install a pilot plant electronic instrumentation system - Phase I 5-9182	J. Chase	Monenco Consultants Ltd.	55.5	08/86	Under negotiation
To develop, design, construct and install a pilot plant electronic instrumentation system - Phase II, 5-91821	J. Chase	RFP	124.5		Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL					
5051 - CARBONIZATION					
Beneficiation of low rank Canadian coals with heavy residua - Phase II, 4-9062 (50/50 cost-sharing)	D. Fung	Gulf Canada Ltd.	139.7	01/86	Final report
Ion microscope studies of the oxidation of coal on a microscope scale, Phase III - Study of coal surfaces by SIMS, 4-9284	J.A. MacPhee	University of Western Ontario	45.7	11/85	Final report, conference presentation & 2 publications
To carry out cage tests in the coke ovens at Algoma Steel Corporation Limited, 5-9106	J. Gransden	Algoma Steel Corp. Ltd.	100.0	03/86	Final report
Potassium vapour impregnation of metallurgical coals, 5-9157	J. Price	McMaster University	35.0	07/86	In progress
5057 - CONVENTIONAL COMBUSTION					
Prediction of flow and temperature conditions in the CCRL drop furnace, 3-9112	P.M.J.Hughes	University of Ottawa	38.9	12/85	Final report, conference presentation & publication
Performance prediction of the CCRL tunnel furnace for coal combustion, 4-9005	H. Whaley	Imperial College of Science and Technology	59.7	01/86	Final report, conference presentation & publication

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5057 - CONVENTIONAL COMBUSTION (cont'd)					
Scanning and transmission electron microscope studies of macerals and pore structure in coals of different rank, 4-9007	K.Thambimuthu	Ontario Research Foundation	45.4	04/85	Final report
Correlation of mineral, maceral and petrophysical characteristics of coal to beneficiation technology, 4-9159 (50/50 cost-sharing)	C. Adams	Atlantic Coal Institute	60.0	07/86	In progress
Design and construction and commissioning of an apparatus for determination of sintering characteristics of coal ashes, 4-9286	K.Thambimuthu	PIL Research Ltd.	90.1	08/86	In progress
Evaluation of combustion options for anthracite utilization, 5-9078 (50/50 cost-sharing)	J. Wong	Gulf Canada Ltd.	24.7	03/86	Final report
Mineral matter spatial distribution in coal as related to the suitability of micronizing techniques in coal combustion, 5-9158	J.A. MacPhee	Atlantic Coal Institute	20.0	03/86	Final report
Continued study on the characterization of coals using photoacoustic infrared Fourier transform spectroscopy and chemical transformation and derivation, 5-9179	J.A. MacPhee	St. Francis Xavier University	62.5	07/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5062 - FLUIDIZED BED COMBUSTION					
Develop a simulation model of the CFB Summerside fluidized bed combustor (FBC) steam heating plant, 4-9044	E.J. Anthony	Queen's University	87.2	03/86	Final report, conference presentation & publication
Measurement of burning rate of Suncor coke in a circulating fluidized bed combustor, 4-9079	E.J. Anthony	Technical University of N.S.	46.1	05/85	Stopped, conference presentation & publication
Combustion, sulphur neutralization and vanadium balance tests with syncrude coke and Fort McMurray limestone in a pilot scale atmospheric recirculating fluidized bed combustor, 4-9239	D. Desai	Polymath Energy Consultants Ltd.	245.9	05/86	In progress
A program of pilot plant-scale R&D on bubbling bed atmospheric fluidized bed combustion, 5-9015	E.J. Anthony	Queen's University	443.1	03/87	In progress
Gas sampling at Tupper AFBC facility, 5-9025	E.J. Anthony	University of New Brunswick	25.5	09/85	Final report
Engineering evaluation of fluidized bed, 5-9214	F. Friedrich	RFP	80.0		Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5068 - COAL LIQUID MIXTURE FUELS					
Coal-water fuel derating assessment for the front wall-fired oil design boiler No. 10 Maritime Electric Company, Charlottetown, P.E.I. 4-9112	H. Whaley	Babcock & Wilcox Canada Ltd.	37.2	02/86	Final report, conference presentation & publication
An assessment of potential coal-water slurry atomizers and burners, 4-9170	H. Whaley	Ralph Grossman Consultant	62.8	05/86	In progress
Industrial scale testing of coal/water slurries in Canada Cement Lafarge's Richmond wet process cement kiln, 4-9248	H. Whaley	Canada Cement Lafarge Ltd.	100.0	07/86	In progress
Combustion and performance testing of coal-water fuel at the Chatham NB generating station, 4-9299	H. Whaley	N.B. Electric Power Commission	200.0	03/86	Final report, conference presentation & publication
Combustion testing of ceramic coal-water fuel (CWF) atomizers in unit No. 1, Chatham, N.B. generating station, 4-9323	H. Whaley	N.B. Electric Power Commission	492.0	06/86	In progress
Testing ceramic nozzles at Chatham, N.B. generating station, 5-9065 (FE)	C. Adams	NRC	30.0	03/86	Completed
Combustion tests of dense coal CWF in a small tunnel furnace, 5-9107	K.Thambimuthu	Technical University of N.S.	41.6	08/86	In progress

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5068 - COAL LIQUID MIXTURE FUELS (cont'd)					
Coal water fuel conversion and combustion testing in an industrial iron ore pelletizing furnace, 5-9190	K.Thambimuthu	Iron Ore Company of Canada	300.0	04/86	In progress
5073 - COMBUSTION TECHNOLOGY FOR POLLUTION ABATEMENT					
To monitor performance testing for low nitrogen and sulphur oxides retrofit burners at Canadian Forces Base, Gagetown, New Brunswick, 3-9153	G.K. Lee	G.A. Robb Associates	40.0	03/86	Final report
Stage combustion parameters for Atlantic coals, 5-9105	G.K. Lee	N.B. Electric Power Commission	188.7	12/86	In progress
Trace constituents program, 5-9123 (FE)	C. Adams	Environment Canada	10.0	03/86	Completed
IEA Coal combustion science, Annex II, 5-9167	H. Whaley	ECN, Holland	600.0	03/88	In progress
Demonstration for in-furnace reduction of SO_x and NO_x in tangential-fired boilers, 5-9239	G.K. Lee	Canadian Electrical Assoc.	100.0	04/86	In progress
5078 - CONSERVATION IN RESIDENTIAL, INDUSTRIAL & TRANSPORTATION SYSTEMS					
Study to investigate furnace system design options to improve operational efficiency of residential gas furnace, Phase IV, plastic heat exchanger, 3-9178	A.C.S. Hayden	Consumers Gas Co.	87.5	07/85	Completed

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5078 - CONSERVATION IN RESIDENTIAL, INDUSTRIAL & TRANSPORTATION SYSTEMS (cont'd)					
Development of a high efficiency oil-fired warm air furnace and domestic water heater, 4-9004	A.C.S. Hayden	Clare Brothers Ltd.	45.0	04/86	In progress
To update, produce and publish combustion handbooks for Canadian fuels, 4-9217	A.C.S. Hayden	Canadian Institute of Energy	93.6	01/86	Final report
Study proposal for ENERSOLVE demonstration project, 4-92831	A.C.S. Hayden	Neil and Gunter Ltd.	18.0	01/86	Final report
Pre-engineering assessment of ENERSOLVE demonstration project in a foundry, 4-92832	A.C.S. Hayden	Kent Engineering Ltd.	17.2	01/86	Final report
Pre-engineering assessment of ENERSOLVE demonstration project in a foundry, 4-92833	A.C.S. Hayden	Hatch Associates Ltd.	16.4	04/85	Final report
Pre-engineering assessment of ENERSOLVE demonstration project - 4-92835	A.C.S. Hayden	Keen Engineering Co. Ltd.	15.2	04/85	Final report
Pre-engineering assessment of ENERSOLVE demonstration project, 4-92836	A.C.S. Hayden	SNC Inc.	19.9	01/86	Final report
A retrofit package for gas-fired furnaces, Phase III, 4-9292	A.C.S. Hayden	Clare Brothers Ltd.	9.0	03/86	Final report
Evaluation of the potential for the application of flue gas condensing systems to industrial boilers, 4-9305	A.C.S. Hayden	Kent Engineering Ltd.	17.1	03/86	Final report

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5078 - CONSERVATION IN RESIDENTIAL, INDUSTRIAL & TRANSPORTATION SYSTEMS (cont'd)					
Evaluation of the potential for the application of flue gas condensing systems to industrial boilers, 4-93051	A.C.S. Hayden	SNC Inc.	44.5	03/86	Final report
Development of method suitable for petroleum refinery used to determine aromatics in heating oils and diesel fuels, 5-9177	S.W. Lee	Chemex Labs Alberta (1984) Ltd.	47.7	07/86	In progress
Development of gas-fired domestic water heater, 5-9207		Eneroil Research Ltd.	15.0		In progress
Prototyping and testing the retrofit of residential gas-fired furnaces with induced draft fans, 5-9208	F. Preto	The Conserver Group Inc.	21.6	05/86	In progress
5080 - ENERGY SYSTEMS					
Heat pump program, 5-9192	A.C.S. Hayden	NRC-ARL	7.5	03/85	Completed
Heat pump program, 5-9197 (FE)	M. Wiggin	NRC	40.0	03/86	Completed
Development of design information for refrigerants and heat pumps, 5-9198 (FE)	M. Wiggin	NRC	50.0	03/86	Completed
Heat pump research - IEA Annex IX, 5-9232 (FE)	M. Wiggin	NRC	33.6	04/86	Completed
Chemical heat pump study, 5-9237	M. Wiggin	Stearns Catalytic Ltd.	80.0	09/86	Under negotiation

Table 2 - List of 1985/86 contracts (cont'd)

Laboratory, sub-sub-activity, contract title and requisition number	Scientific authority	Contractor	Contr. value $'000	Date completed	Status or output
Contracts administered by CCRL (cont'd)					
5084 - BIOMASS FUELS FOR RESIDENTIAL AND INDUSTRIAL COMBUSTION					
To evaluate and improve the accuracy and efficiency of emission ratings of central chunk wood fired warm air heating systems, 4-9282	R. Braaten	Centre de recherche industrielle du Québec	49.0	09/85	Final report

Table 3 - Values of solicited, UP and 50/50 contracts in 1985/86

Sub-sub-activity laboratory	Solicited in		UP from		50/50 from		Total value	Average
	1984/85	1985/86	1984/85	1985/86	1984/85	1985/86	in 1985/86	value
	$'000							
Development of catalytic processes for hydrocarbon conversion and distillate upgrading	943.2	689.5	217.4	118.1	201.2	187.6	2357.1	102.5
Characterization of liquid fuels & development of separation processes	605.1	555.1	181.6	125.4	261.3	122.7	1851.2	80.1
Conversion of natural gas to liquid fuels	122.8	462.0	196.3	110.0	273.7	106.5	1271.3	84.8
Gasification and pyrolysis	162.9	535.1	141.1	54.9	46.3	36.5	976.8	69.8
HPRL total	1834.0	2241.7	736.4	408.5	782.5	453.3	6456.4	86.1
Recovery of bitumen/heavy oils (contracts)	616.1	407.7	-	296.4	146.0	194.3	1660.5	151.0
Recovery of bitumen/heavy oils (EMR contributions)	-	-	-	-	-	-	3489.6	872.4
Development of upgrading technologies for bitumen/ heavy oil and residuals	949.2	511.4	-	65.9	-	-	1526.5	152.7
Evaluation of liquefaction and pyrolysis processes for Canadian coals	152.1	201.6	-	-	280.9	124.7	759.3	94.9
Development of bitumen/heavy oil & coal coprocessing technology	250.8	273.7	-	-	-	-	524.5	104.9
SFRL total	1968.2	1394.4	-	362.3	426.9	319.0	7960.4	204.1
Carbonization	45.7	135.0	-	-	137.2	-	317.9	79.5
Conventional combustion	178.4	82.5	84.3	-	-	84.7	429.9	53.7
Fluidized bed combustion	245.9	523.1	133.3	25.5	-	-	927.8	154.6
Coal-liquid mixture fuels	780.2	396.6	100.0	-	-	-	1276.8	159.6
Combustion technologies for pollution abatement	44.9	798.7	-	100.0	-	-	943.6	188.7
Conservation in residential, industrial and transportation systems	338.4	47.7	35.0	36.6	-	-	457.7	32.7
Energy systems	-	211.1	-	-	-	-	211.1	42.2
Biomass fuels for residential & industrial utilization	49.0	-	-	-	-	-	49.0	49.0
CCRL total	1682.5	2194.7	352.6	162.1	137.2	84.7	4613.8	90.5
ERL total	5484.7	5830.8	1089.0	1306.9	1346.6	857.0	19030.6	115.3

UP - Unsolicited proposal contract; 50/50 - cost-shared contracts

Table 4 - Summary of shared-cost contracts in 1985/86

Sub-sub-activity	No. of contracts awarded in		Total contract value	CANMET share of 1985/86 expenditure
	1984/85	1985/86	$'000	
Development of catalytic processes for hydrocarbon conversion and distillate upgrading	2	2	777.6	209.4
Characterization of liquid fuels & development of separation process	2	3	753.6	210.2
Conversion of natural gas to liquid fuels	2	1	760.4	94.4
Gasification and pyrolysis	1	1	165.6	45.0
Recovery of bitumen and heavy oils	2	2	680.6	164.5
Evaluation of liquefaction and pyrolysis processes for Canadian coals	2	1	811.2	231.8
Carbonization	1	-	274.4	64.7
Conventional combustion	-	2	169.4	41.7
Total	12	12	4397.8	1061.7

Table 5 - Types of contracting-out organizations for 1985/86 contracts

Sub-sub-activity laboratory	Private company	Para-public organization	University	RFP	Total
Development of catalytic processes for hydrocarbon conversion and distillate upgrading	8	5	10	-	23
Characterization of liquid fuels & development of separation processes	10	10	1	2	23
Conversion of natural gas to liquid fuels	3	5	7	1	15
Gasification and pyrolysis	4	2	7	-	14
HPRL total	25	22	25	3	75
Recovery of bitumen/heavy oils (contracts)	6	1	4	-	11
Recovery of bitumen/heavy oils (EMR contributions)	-	4	-	-	4
Development of upgrading technologies for bitumen/heavy oils and residuals	1	2	6	1	10
Evaluation of liquefaction and pyrolysis processes for Canadian coals	3	4	1	-	8
Development of bitumen/heavy oil & coal coprocessing technology	4	-	1	1	6
SFRL total	14	11	12	2	39
Carbonization	2	-	2	-	4
Conventional combustion	3	2	3	-	8
Fluidized bed combustion	1	-	4	1	6
Coal-liquid mixture fuels	4	3	1	-	8
Combustion technologies for pollution abatement	1	4	-	-	5
Conservation in residential, industrial & transportation systems	14	-	-	-	14
Energy systems	-	4	-	1	5
Biomass fuels for residential and industrial utilization	-	1	-	-	1
CCRL total	25	14	10	2	51
ERL total	64	47	47	7	165

Table 6 - Contract fund budget, expenditures and carryovers for 1985/86
($'000)

Sub-sub-activity laboratory	Budget allotted by RPO	Actual Expenditures in 1985/86	Carry overs to 1986-87	Per cent of fund utilization	Number of contracts
	A	B	C	$\frac{A}{B} \times 100$	-
Development of catalytic processes for hydrocarbon conversion and distillate upgrading	518.9	768.8	1023.1	148.2	23
Characterization of liquid fuels & development of separation processes	690.0	787.3	870.8	114.1	23
Conversion of natural gas to liquid fuels	458.6	579.6	455.8	126.4	15
Gasification and pyrolysis	240.5	232.2	450.0	96.5	14
HPRL total	1908.0	2367.9	2799.7	124.1	75
Recovery of bitumen/heavy oil (contracts)	14.7	363.4	492.4	2472.1	11
Recovery of bitumen/heavy oil (EMR contributions)	331.7	339.0	2825.6	102.2	4
Development of upgrading technologies for bitumen/heavy oils and residuals	197.3	265.2	601.6	134.4	10
Evaluation of liquefaction and pyrolysis processes for Canadian coals	233.5	226.9	234.4	97.2	8
Development of bitumen/heavy oil and coal coprocessing technology	221.7	221.8	288.7	100.0	6
SFRL total	998.9	1416.3	4442.7	141.8	39*
Carbonization	208.4	211.8	33.5	101.6	4
Conventional combustion	167.8	165.5	178.1	98.6	8
Fluidized bed combustion	465.4	504.3	472.6	108.4	6
Coal-liquid mixture fuels	630.6	1018.6	277.0	161.5	8
Combustion technologies for pollution abatement	128.1	160.3	358.7	125.1	5
Conservation in residential and transportation systems	249.9	259.0	56.0	103.6	14
Energy systems	455.5	387.3	80.0	85.0	5
Biomass fuels for residential and industrial utilization	40.6	45.5	0.0	112.1	1
CCRL total	2346.3	2752.3	1455.9	117.3	51
ERL total	5253.2	6536.5	8698.3	124.4	165*

* Including 4 financial contributions

Table 7 - Publications, conference presentations and patents granted from 1985/86 contracting-out program

Sub-sub-activity laboratory	Final reports	Publications	Conference presentation	CANMET reports	Patents
Development of catalytic processes for hydrocarbon conversion and distillate upgrading	9	11	10	1	1
Characterization of liquid fuels & development of separation processes	5	1	-	-	1
Conversion of natural gas to liquid fuels	4	4	3	-	2
Gasification and pyrolysis	8	2	2	-	1
HPRL total	26	18	15	1	6
Recovery of bitumen and heavy oils	6	6	6	-	-
Development of upgrading technologies for bitumen/heavy oil and residuals	3	-	-	-	-
Evaluation of liquefaction and pyrolysis processes for Canadian coals	5	2	2	-	2
Development of bitumen/heavy oil and coprocessing technology	2	-	-	-	-
SFRL total	16	8	8	-	2
Carbonization	3	2	1	-	-
Conventional combustion	5	2	2	-	-
Fluidized bed combustion	2	2	2	-	-
Coal-liquid mixture fuels	2	2	2	-	-
Combustion technologies for pollution abatement	1	-	-	-	-
Conservation in residential, industrial & transportation systems	10	-	-	-	-
Energy systems	0	-	-	-	-
Biomass fuels for residential and industrial utilization	1	-	-	-	-
CCRL total	24	8	7	-	-
ERL total	66	34	30	1	8